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October 21, 2004
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Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Ms. K. R. Cotton

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
NRC BULLETIN 2003-01, POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS - REQUEST FOR ADDITIONAL INFORMATION

Reference:
1. S. A. Byrne to Document Control Desk, Bulletin 2003-01, 60-Day Response, dated August 6, 2003, RC-03-0164

2. K. R. Cotton, NRC, to Stephen A. Byrne Letter dated September 9, 2004, Request for Additional Information Regarding Bulletin 2003-01, (TAC NO. MB9617)

By the referenced letter (Reference 1), South Carolina Electric & Gas Company (SCE&G) provided the 60-day response to NRC Bulletin 2003-01 for the Virgil C. Summer Nuclear Station (VCSNS). In a letter dated September 9, 2004 (Reference 2), the NRC requested additional information from SCE&G in order to complete their review. The attachment to this letter contains the responses to the NRC request.

Should you have questions, please call Mr. Ron Clary at (803) 345-4757.

I certify under penalty of perjury that the information contained herein is true and correct.

10/21/04
Executed on

Jeffrey B. Archie
Vice President, Nuclear Operations

AMM/JBA/dr
Attachment

A103

c: N. O. Lorick
N. S. Carns
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RTS (C-03-1897)
File (815.02)
DMS (RC-04-0164)

**Attachment**

Request For Additional Information
Bulletin 2003-01, "Potential Impact of Debris Blockage on
Emergency Sump Recirculation at Pressurized-Water Reactors"

Following are the questions and applicable responses to the NRC request for additional information.

1. **On page 7 of Attachment 1 of your Bulletin 2003-01 response, you discuss an ongoing effort to update Plant Support Engineering Guideline 08 for Technical Support Center System Engineers, to include a response to sump clogging. However, your response does not completely discuss the guideline update to be developed, nor does it provide a schedule for its completion. Please provide a schedule for this effort, a detailed discussion of the guideline changes with respect to operator-identified instances of sump clogging, and the response actions the operators would be instructed to take in the event of sump clogging and loss of ECCS recirculation capability.**

   RESPONSE:

   The purpose of the guide is to provide guidance for Plant Support Engineering personnel in performing duties when assigned to the Technical Support Center in support of the station's Emergency Plan. During response preparation to Bulletin 2003-01, PSEG 08 was reviewed. A commitment was made to add guidance on sump clogging as a part of an on-going effort under the V.C. Summer corrective action program. A revision to the guideline was completed in May 2004. Three appendices were updated for sump clogging considerations.

   Appendix A, which covers equipment required for long term cooling, was revised to include sump clogging as a potential failure mechanism for long term cooling. Appendix F, which covers long term plant status evaluation, was updated to include monitoring for sump clogging. Appendix S, which covers long-term evaluation of reactor building conditions, was updated in two sections.

   Under the containment spray termination section, the following bullet was added:

   > "Reducing RB spray helps to limit debris transport to the recirculation sump and thereby reduce the potential for sump blockage. RB spray should be terminated (one pump at a time) when RB pressure is below the EQ envelope and decreasing."

Under the long-term management of ECCS alignment, the following bullet was added"

> "Clogging of the recirculation sump may occur at any point following alignment for long term cooling. Indications of sump blockage include unstable motor amps, pump discharge pressure, and pump flow rate. These indications need to be monitored and the pumps protected should sump blockage occur."

These updates were completed consistent with the format and intent of the guideline. The guide is not used by the operators and is not intended to cover specific operator actions to respond to sump clogging. The operator actions for sump clogging are covered under EOP-2.4 as outlined in the V.C. Summer response to Bulletin 2003-01 (letter RC-03-0164, dated August 6, 2003).

2. **On page 8 of Attachment 1 of your Bulletin 2003-01 response, you state that "a change to VCSNS EOPs based on overall risk improvement cannot be justified without appropriate industry review of the issue." On page 9 of Attachment 1 of your Bulletin 2003-01 response, you state, "if the generic [owners group] guidance is approved and issued, VCSNS will determine if the implementation is appropriate for an overall risk reduction." The Westinghouse Owners Group (WOG) has developed operational guidance in response to Bulletin 2003-01 for Westinghouse and CE-type pressurized water reactor (PWRs). Please provide a discussion of your plans to consider implementing this new WOG guidance. Include a discussion of the WOG-recommended compensatory measures that have been or will be implemented at your plant, and the evaluations or analyses performed to determine which of the WOG-recommended changes are acceptable at your plant. Provide technical justification for those WOG-recommended compensatory measures not being implemented by your plant. Also, include a detailed discussion of the procedures being modified, the operator training being implemented, and your schedule for implementing these compensatory measures.**

RESPONSE:

SCE&G has performed a review of the WOG operational guidance provided in WCAP-16204, Revision 1. The Candidate Operator Actions (COA's) listed in the WCAP identify generic interim compensatory EOP changes to address the potential for sump clogging. Following is a summary of those COA's (numbered as they are in the WCAP) applicable to VCSNS.

*A1a - Secure One Spray Pump Prior to Recirculation*

Advantages

Reduces wash down of upper containment
Increases injection time to allow materials to settle out of solution
Helps on small and intermediate breaks

Disadvantages

Little help on large break LOCA
Single failure issue during the transfer to recirculation

Risk Neutral per the WOG
Potential Candidate for VCSNS – If both spray pumps and both containment fan coolers are operating, stopping one spray pump will not adversely affect peak containment pressures. Additional analysis is necessary to support loss of spray flow for a period of time to support single failure concerns. This loss of spray flow is applicable should the running pump fail or if the operating pump switchover valves do not operate properly during transfer to recirculation. In both cases time critical operator actions will be necessary to restart the non-running pump. Implementation of this COA cannot be implemented under 10CFR50.59 and will require plant specific NRC review and approval of a license amendment. Changes to EOPs 1.0, 2.0 and 2.2 would be likely.

Qualitatively, this COA has very limited advantages for VCSNS. For large break LOCA little benefit would be realized because of the limited amount of time that would be available to secure 1 train without negatively impacting timelines associated with transfer to recirculation. Greater potential for some added benefit may be available for a small break LOCA; however, for the small break LOCA the potential for sump clogging is inherently much less due to the limited debris generation and reduced flows associated with the event. Therefore any overall benefit from this COA for VCSNS is perceived to be small.

Based on the above discussion, implementation of this COA is not recommended. Based on the time requirements necessary to both process a license amendment and properly train operators on the major changes that would be required of the EOPs, the compensatory action would only be available for a very limited period of time (less than 1 operating cycle) prior to completion of analysis and, if necessary, long term permanent corrective actions in response to Generic Letter 2004-02. Subsequent re-training of operators would then be necessary to address the final corrective actions. SCE&G does not consider the potential short term benefits to be obtained

by implementing this COA to out weigh the burden and confusion that may be created prior to the final corrective actions being completed in the plant.

*A2 – Manually Establish One Train to Recirculation for RWST Lo-Lo Level*

Advantages

Eliminate common cause failure of both trains due to sump clogging

Decrease flow through containment sump

Disadvantages

Items under Advantages are not applicable to VCSNS

Requires makeup to RWST (limited to about 100 gpm at VCSNS)

Not recommended by WOG for plants without substantial RWST makeup. Not a candidate for VCSNS since we have limited RWST makeup and the advantages are not applicable to VCSNS.

A possible alternative consideration for VCSNS was to switch the containment spray over to recirculation prior to reaching the RWST Lo-Lo Level. This action would prolong injection from the RWST to the RCS providing additional time for material to settle out of the sump solution. Also the containment spray pump screens would start to filter out the fibers and particulate material. Except for design basis events, the containment spray system is only expected to operate for 2 hours. Running a spray pump on recirculation before aligning the RHR pump(s) for recirculation would cleanup the sump solution. By catching material on the containment spray pump screens, the likelihood of RHR sump screen clogging would be reduced.

To determine the actual feasibility and benefit of this alternative would require detailed analysis and computer modeling. Qualitative assessments indicate that the overall benefit to be gained by this approach would be small. This action would have some minimal benefit for small break LOCA conditions for the reasons described in the previous paragraph. However since potential sump clogging debris is significantly reduced in a small break LOCA, the benefits are not expected to be significant. For a large break LOCA, because of the manual actions necessary to implement this action, and the time constraints that are imposed to support the RWST swapover, this action has the potential to negatively impact the required RWST swapover timeline. SCE&G therefore considers the overall risk to implement this alternative consideration to be unwarranted based on qualitative judgment.

*A3 – Terminate One Train of SI After Recirculation*

Advantages

Reduces debris transport to sump
Reduce flow through the sump screen (not for VCSNS)
Preserve operable SI train
Preserve screen in dual sump design

Disadvantages

Throttle criteria change (not applicable to VCSNS since we split trains)
NPSH (not applicable to VCSNS since we split trains)
Single failure (requires manual operator action to restart pumps)

WOG does state there are advantages for dual sump plants.
Potential candidate for VCSNS since we have dual sumps – The advantage of terminating recirculation flow from one train is that debris (fibrous and particulate) will accumulate on the one set of sump screens. If the operating train sump screen becomes clogged, the second train can be started. The second train is less likely to clog since some of the debris will have been removed from the sump solution. A time critical operator action will need to be added for restart of the second train. Changes to EOP 2.2 will be required, as well as other EOPs that will require continuous action statements to monitor pump performance and subsequently transfer to EOP 2.2 to align the second train should the operating train sump screen clog.

As with COA A1a, this approach cannot be implemented under 10CFR50.59 and will require plant specific NRC review and approval of a license amendment. Based on the same justification contained in the A1a response above, implementation of this COA is not recommended at this time.

*A5 – Refill RWST*

*After Initiating Recirculation*

Advantages

Does not adversely impact current analyses
No operator action prior to recirculation

Disadvantages

May exceed RB flood level
Does not extend injection phase

*Before Recirculation*

Advantages

Extend injection time

Disadvantages

May exceed RB flood level
Operator action required early in event response

Possible long-term boron dilution

WOG recommends refill of RWST. Whether or not to use the refill to extend injection is plant specific.
For VCSNS, recommend refill of RWST after injection – The refill rate of the RWST at VCSNS is relatively low (about 100 gpm). This makes it less effective to refill during injection. Additionally, exceeding the maximum flood level (420 feet) could challenge long-term cooling even without sump screen clogging. With the low effectiveness and possible adverse effects, refill of the RWST during injection is not recommended for VSCNS; however, refill after completion of the switchover is recommended. While this will not reduce the possibility of sump clogging, it will provide an increased borated water source should blockage occur. EOP 2.4 directs operators to inject from the RWST using the charging pumps if recirculation is lost. The change will be to EOP 2.2 after completion of switchover and train separation. Implementation and operator training for this COA will be completed by June 1, 2005.

*A8 – Provide Guidance on Symptoms and ID of Sump Clogging*

Advantages

Reduce consequences of sump blockage

Disadvantages

Limited instrumentation to assess sump blockage
Instrumentation not RG 1.97
Additions to time critical steps
Indications do not have specific action setpoints
Incorrect diagnosis of sump blockage could have adverse impact

WOG recommends for most plants
Candidate for VCSNS (currently implemented) – As previously indicated in the original SCE&G response to Bulletin 2003-01 (see Reference 1.), EOP 2.2 currently instructs the operator to monitor the RHR pumps for signs of sump blockage in a continuous action step. If recirculation is lost or becomes severely degraded, the operators are instructed to transition to EOP 2.4 for loss of recirculation flow. Classroom and simulator training on sump blockage has been a part of the licensed operator curriculum for years, as well as being included in site-wide Emergency Planning Drills. As additional improvements to training, procedures, equipment and instrumentation are identified, those items will be evaluated and implemented as necessary.

*A9 – Develop Contingency Plan for Loss of Suction*

Advantages

Reduces consequences of sump blockage
Consistent with existing procedures

Disadvantages

Incorrect diagnosis of sump blockage could have adverse impact

WOG recommends for most plants
Candidate for VCSNS – SCE&G plans to develop a new EOP based on the guidance of Sump Blockage Control Room Guideline (SBCRG) 1. Completion of EOP development and training for the operators will be completed by October 17, 2005. Training on this EOP will be conducted in conjunction with the other major changes to EOP 2.2 (see item #3 below) associated with these compensatory actions to provide for a more comprehensive and integrated implementation process.

The following COAs were either not recommended by the WOG for implementation or not applicable to VCSNS. They will not be implemented at VCSNS.

*A1b – Secure Both Spray Pumps Prior to Recirculation*

WOG recommends do not implement this COA for plants with a Spray Additive Tank (SAT). VCSNS has a SAT.

*A4 – Early Termination of One RHR Pump before Recirculation*

WOG recommends do not implement.

*A6 – Inject More than One RWST Volume*

WOG has no specific recommendation.

*A7 – Provide More Aggressive Cooldown and Depressurization*

Not applicable for Westinghouse plants.

*A10 – Early termination of One Charging Pump before Recirculation*

WOG recommends do not implement.

3. **NRC Bulletin 2003-01 provides possible interim compensatory measures licensees could consider to reduce risks associated with sump clogging. In**

**addition to those compensatory measures listed in Bulletin 2003-01, licensees may also consider implementing unique or plant-specific compensatory measures, as applicable. Please discuss any possible unique or plant-specific compensatory measures you considered for implementation at your plant. Include a basis for rejecting any of these additional considered measures.**

RESPONSE:

Two potential changes to the long-term core cooling procedures were identified during the Bulletin 2003-01 response preparation. The first was stopping one train of recirculation after successful alignment and separation of two trains for long-term cooling. This action was added later to the industry evaluation effort and is discussed under item #2 above.

The second compensatory measure identified is the use of throttle valves in the RHR/LHSI system to reduce RHR/LHSI pump flow rate. Air-operated butterfly valves are located downstream of each RHR heat exchanges (valve numbers HCV-603A and HCV-603B). These valves are designed to fail open upon loss of instrument air and do not provide a safety related function during long term cooling. However, instrument air is restored as a part of the current EOPs and the valve controls are located on the Main Control Board (MCB).

The reduction of RHR/LHSI recirculation flow provides the following benefits:

- Reducing pump flow reduces the required NPSH. This would allow increased sump strainer differential pressure without pump cavitation.
- A reduced pump flow will reduce headloss through the strainer.
- Reduced pump flow reduces the transport velocities to the sump area. Lower transport velocities will reduce debris transport to the sump.
- A reduced pump flow will reduce the rate of debris accumulation on the sump strainer. If strainer clogging were still to occur, it would occur at a later time when decay heat and containment pressure and temperature are further reduced.

After alignment for long-term cooling, the operators will be instructed to throttle RHR flow as indicated on the Main Control Board. The total recirculation flow from two throttled RHR trains will exceed the single train minimum flow assumed in the long-term pressure and temperature analysis presented in Chapter 6 of the FSAR. The operators will be instructed to throttle RHR flow while monitoring Reactor Building pressure and temperature. Pressure and temperature indications are provided on

the MCB. Monitoring these parameters provides further assurance the system design and analysis limits will continue to be met.

The scheduled implementation date for the EOP 2.2 changes and the required operator training is October 17, 2005. This training will be performed in conjunction with COA A9 (discussed in item 2 above) to provide for an integrated and logical implementation approach.